

New Records of Nudibranchia
(Gastropoda : Opisthobranchia : Nudibranchia)
from the Central and West-Central Pacific
with a Description of a New Species

BY

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(18 Text figures)

INTRODUCTION

INFORMATION ON THE nudibranchiate opisthobranchs of the Central and West-Central Pacific consists chiefly of morphological studies on preserved specimens collected during exploratory expeditions to the Pacific Islands. A recent example is the taxonomic study of MARCUS (1965) on Micronesian opisthobranchs in which 28 species of nudibranchs are identified, 7 of which are new.

The purpose of this paper is to present new records and biological notes of nudibranchs collected from Palmyra Atoll, Johnston Island, and Eniwetok Atoll. Palmyra Atoll, the northernmost of the Line Islands, is located at 5° 51' N and 162° 04' W. Johnston Island, which is located at 16° 15' N and 169° 30' W, is unusual in that it has a marginal reef only at one side and that it comprises the only land mass in the triangular area formed by the Hawaiian Islands 450 miles to the northeast, the Line Islands 700 miles to the southeast and the Marshall Islands 1300 miles to the west. Eniwetok Atoll, one of the westernmost of the Marshall Islands, is located at 11° 30' N and 162° 15' E.

Nudibranchs have not previously been reported from Palmyra Atoll and Johnston Island, whereas MARCUS & BURCH (1965) report 8 species of nudibranchs from Eniwetok Atoll, 2 of which are new. One specimen of *Hexabranchnus marginatus* (QUOY & GAIMARD, 1832), identified by MARCUS (1965) from a 1946 collection of J. P. E. Morrison, in addition to these 8 species, makes a total of 9 nudibranchs previously reported from Eniwetok.

ACKNOWLEDGMENTS

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COLLECTIONS AND METHODS

Except for one specimen collected from Igurin Island, Eniwetok Atoll, two specimens from Palmyra Atoll and one specimen from Johnston Island, the nudibranchs discussed in this paper are from three locations on Eniwetok Atoll: (1) a subtidal flat at the northern lagoonward side of Chinimi Island, (2) a tidepool on the northern lagoonward side of Eniwetok Island, and (3) the quarry on the northern seaward reef of Eniwetok Island. These three sites represent a type of shallow water environment relatively rare on Eniwetok Atoll: rock areas comparatively free of sand and carbonate sediment and with a free exchange of water at all stages of the tide.

Collections were made from the intertidal zone to a depth of 5 meters. Species of *Doridacea* from Hawaii referred to in this paper were collected from the islands of Oahu and Kauai between 1962 and 1966. Descriptions, figures and ecological notes will be given for these and other species in a paper by KAY & YOUNG (in preparation).

Descriptions, measurements and drawings of external morphological features were made from live specimens. Observations of feeding, when possible, were made from animals held in laboratory aquaria. Internal anatomical examination was performed on specimens relaxed by refrigeration, fixed in 5% formalin and stored in 70% ethyl alcohol. Animals are described and figured where these data are not adequately provided in the literature.

SPECIES

DORIDACEA

DORIDIDAE

Doriopsis viridis PEASE, 1861

(Text figures 1 to 3)

Doriopsis viridis PEASE, 1861: 244-245; PEASE, 1871: 301, pl. 19, figs. 1a, 1b, 1c

Guyonia viridis (PEASE), RISBEC, 1928 (in part): 106 (*variété verte* not *variété bleu*)

Doriopsis viridis (PEASE), RISBEC, 1953 (in part): 45 (*variété verte* not *variété bleu*)

Description: *Doriopsis viridis* has an oblong body that is flattened dorso-ventrally (Figure 1). No specimens were found greater than 8 mm in length and 3 mm in width. The mantle, foot, rhinophores and branchiae are olive green to bronze green. The mantle, which flares around the foot, is firm and has small spiculate pustules resembling "granules" over the dorsum. Along the mid-dorsum, elongate epidermal spicules are arranged diagonally in

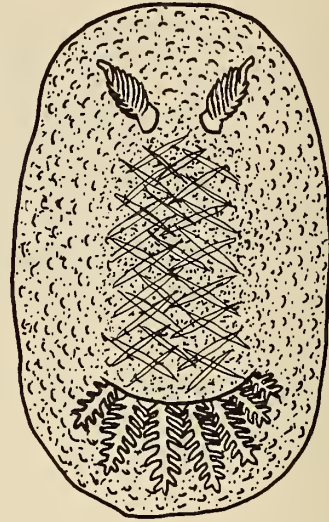


Figure 1

Doriopsis viridis
Dorsal view of adult specimen

approximately alternate series. The 7 to 8 branchiae are simply pinnate and retractile into the transversely positioned, crescent shaped branchial sheath at the posterior end of the mantle. The rhinophores are rod-like with 6 to 9-lamellae and are retractile into separate sheaths.

The radular formula of 2 specimens, 6 and 8 mm long, is 26-30 x 24-26 · 0 · 24-26 (Figure 2). The radular teeth are hamate, non-denticulate and range in size from 46 μ to a maximal length of 119 μ in an 8 mm specimen. The largest teeth are centrally positioned within each row. No jaws are present. Ducts in the female portion of the reproductive system (Figure 3, ud, v) are parallel in arrangement. The spermatocyst (sc) is ovate-oblong and smaller than the spherical spermatheca (st).

Habits: Four specimens were collected on the lagoon side of the northern end of Chinimi Island, Eniwetok Atoll. Specimens were found eating the orange sponge, *Prianos phlox* DE LAUBENFELS, 1954, which occurred in abundance on the undersides of rocks at the collecting site. Examination of feces revealed spicules of the same sponge and laboratory feeding tests suggested that specimens of *Doriopsis viridis* fed exclusively on *P. phlox*.

A 7 mm specimen produced a light yellow, ribbon-like egg mass, 60 mm long and 1.5 mm wide, with 3 whorls. The egg mass contained approximately 72 ova per mm². Each ovum was enclosed by a capsule 150 μ to 162 μ in diameter. The larvae hatch as free swimming veligers.

Remarks: Two color "varieties" of *Doriopsis viridis* are

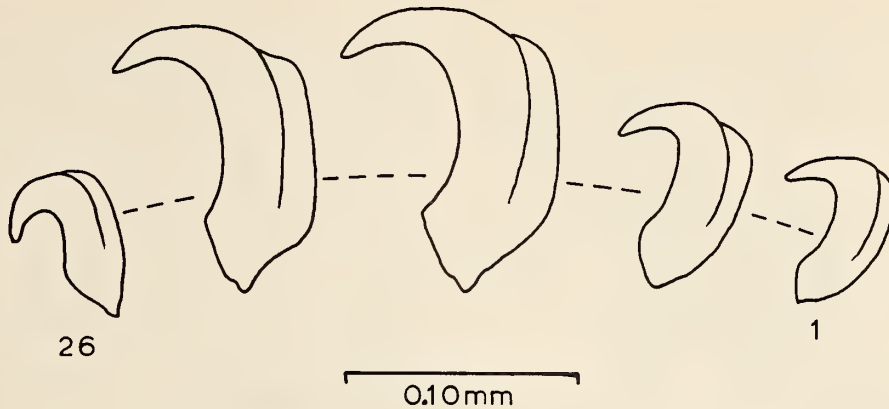


Figure 2
Doriopsis viridis
 Lateral view of the left half row of radular teeth
 1 = innermost lateral 26 = outermost lateral

proposed (RISBEC, 1928, 1953) and *Doriopsis pecten* COLLINGWOOD, 1881, the blue variety, is synonymized with *D. viridis* PEASE, 1861, the green variety (ALLAN, 1947; BABA & HAMATANI, 1961). The two species are similar in many external and internal morphological characters, but when specimens of similar size are compared, specimens of *D. viridis* have larger eggs, larger radular teeth and fewer teeth per radular row than specimens of *D. pecten*. The species are further distinguished by different feeding habits (see below).

Specimens of *Doriopsis viridis* are reported from Tahiti (PEASE, 1861, 1871) and New Caledonia (RISBEC, 1928, 1953).

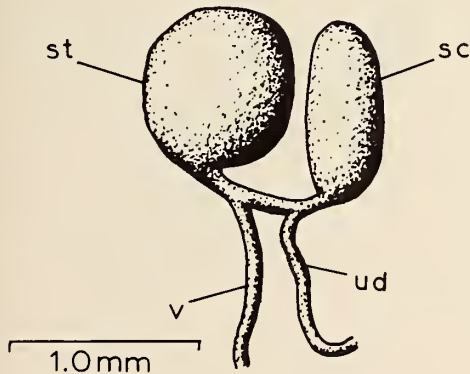


Figure 3
Doriopsis viridis
 Lateral view of the female duct system
 sc = spermatocyst st = spermatheca ud = uterine duct
 v = vaginal duct

Doriopsis pecten (COLLINGWOOD, 1881)

Description: The animal is figured and described by COLLINGWOOD (1881), ALLAN (1947) and BABA & HAMATANI (1961). The radular formula is given by BABA & HAMATANI (1961). HAMATANI (1961) provides a photograph of specimens in association with encrusting blue sponge colonies and descriptions of eggs and veliger larvae. Synonymies are given and additional features of the external and internal morphology of *Doriopsis pecten* are described and figured by KAY & YOUNG (in preparation). **Habits:** Four specimens (6 mm to 11 mm long) were collected at Eniwetok Atoll. One specimen was found in the quarry on Eniwetok Island in 2 m depth and the other specimens were collected from 0.5 m depth on the northern lagoonward side of Chinimi Island. They were seen feeding on the blue sponge, *Terpios aploos* DE LAUBENFELS, 1954, which was fairly abundant under rocks and in crevices in dead coral at both collecting sites. Spicules of *T. aploos* were found in the feces and gut contents of freshly collected specimens. Specimens of *Doriopsis pecten* in Hawaiian waters (unpublished data) were also found to specifically eat *T. aploos*.

Remarks: The occurrence of mutually exclusive feeding habits is confirmatory ecologic evidence that *Doriopsis pecten* and *D. viridis* are distinct species and that the blue coloration of *D. pecten* is specifically diagnostic.

Specimens of *Doriopsis pecten* are reported from Taiwan (COLLINGWOOD, 1881), Japan (BABA & HAMATANI, 1961), New South Wales (ALLAN, 1947), and are found in Hawaii (KAY & YOUNG, in preparation) in addition to New Caledonia (RISBEC, 1928, 1953), where they co-occur with specimens of *D. viridis*.

Hypselodoris tryoni (GARRETT, 1873)

(Text figures 4 to 7)

Goniodoris tryoni GARRETT, 1873: 232; plt. 4

Chromodoris tryoni (GARRETT), BERGH, 1877: 490; BERGH, 1884: 69

Description: *Hypselodoris tryoni* has an elongate smooth body up to 60 mm in length and 18 mm in width (Figure 4). The convex mantle is expanded anteriorly as a hood,

rounded posteriorly and held above the foot. The foot is elongate, tapered and projected posteriorly beyond the mantle edge. The background color of the mantle is cream or light brown. The mantle is bordered and spotted with purple maculae each of which is surrounded by a white areola in turn encircled by a pale fawn ring. The foot is white, margined with lilac and covered with spots similar to those on the mantle. The rhinophores are rod-like, elongate, finely lamellate, retractile into widely separated sheaths, and brown with a white medial streak anteriorly. The 14 to 16 branchial plumes, which encircle the posteriorly positioned anus, increase in arborization and decrease in size posteriorly. They are erect, vibratory and white with red-brown margins. The rhachides are quadrangular in cross section and retractile into a common cavity.

The radular formula of a 60 mm specimen is 94 x 58-0-58 (Figure 5). The innermost radular tooth is simply



Figure 4

Hypselodoris tryoni
Dorsal view of adult specimen



0.025 mm

Figure 6

Hypselodoris tryoni
Elements of the buccal armature

bicuspid and 50 μ long. Within each row, denticulation increases laterally to a maximum of six outer denticles and tooth length increases centrally to 83 μ . The buccal arma-

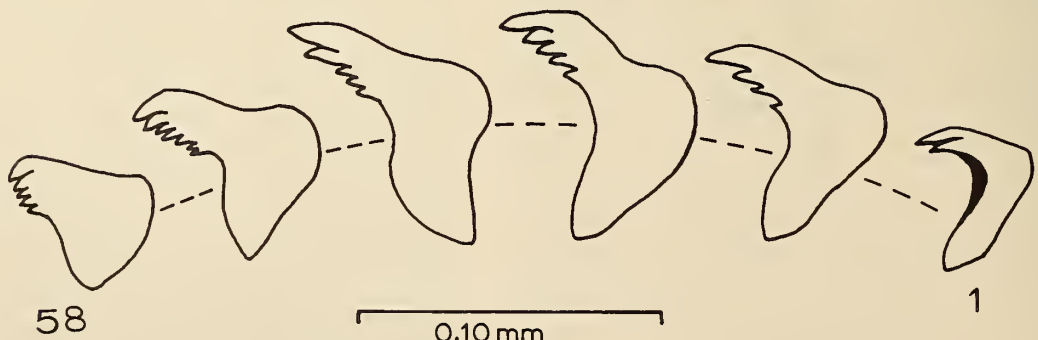


Figure 5

Hypselodoris tryoni
Lateral view of the left half row of radular teeth
1 = innermost lateral 58 = outermost lateral

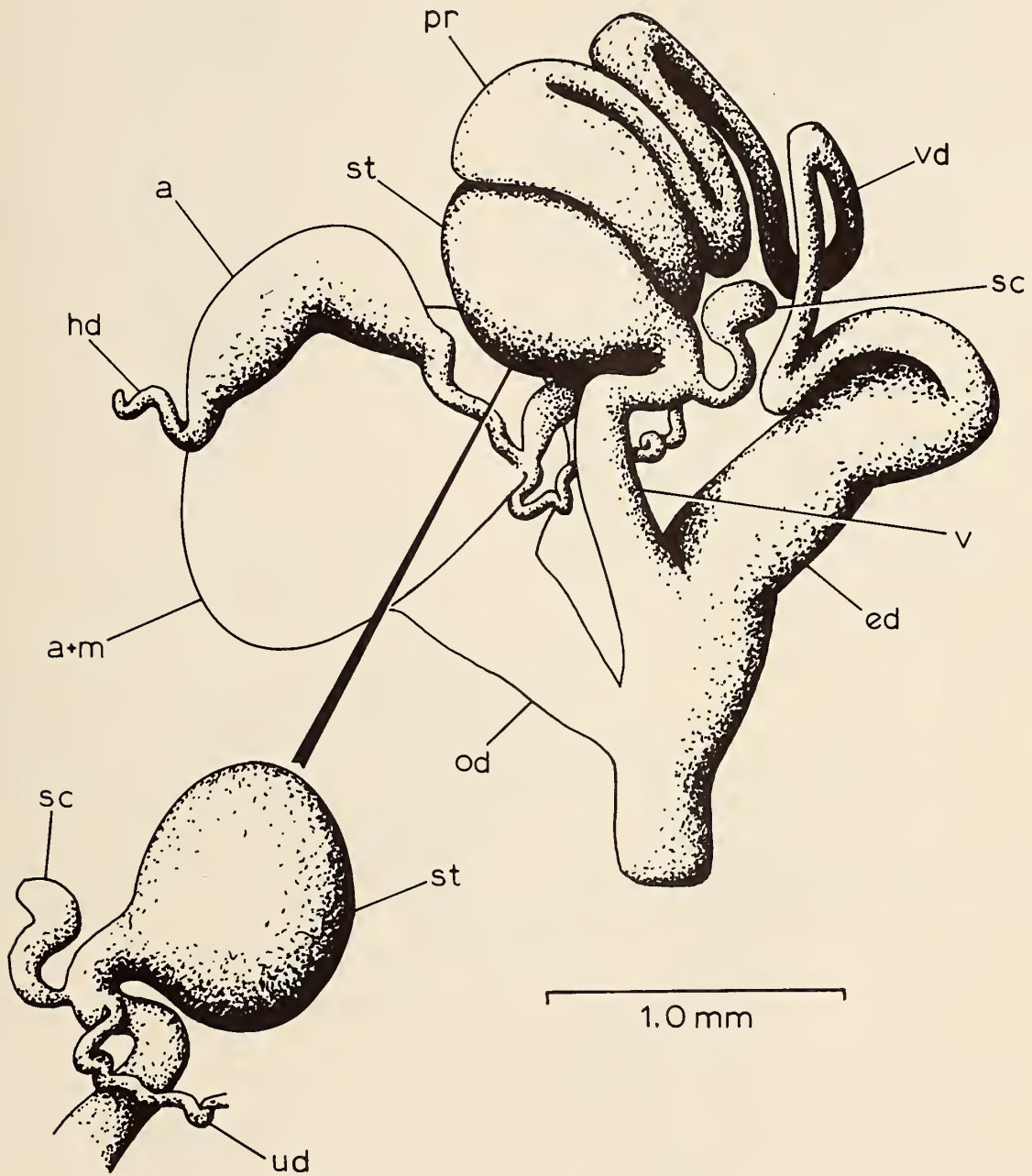


Figure 7

Hypsclodoris tryoni

Lateral view of the genital mass with an offset of a medial view of the female duct system

- | | | | | |
|-----------------------|--------------------------------|-------------------|---------------------|-------------------|
| a = ampulla | a+m = albumin and mucous gland | od = oviduct | pr = prostate gland | sc = spermatocyst |
| ed = ejaculatory duct | hd = hermaphroditic duct | st = spermatheca | ud = uterine duct | v = vaginal duct |
| | | vd = vas deferens | | |

ture, which ranges in length from 45 to 50 μ , has singly hooked tips and long sculptured bases (Figure 6).

A common orifice (Figure 7) is shared by the ejaculatory duct (ed), vaginal duct (v) and oviduct (od). No cirral hooks line the ejaculatory duct. The elongate prostate gland (pr) partially envelops the spermatheca (st). The vaginal duct is short and non-convolute and passes directly into the spherical spermatheca. A short duct passes from the spermathecal end of the vaginal duct into the small pyriform spermatocyst (sc). A long, tightly convolute uterine duct (ud) joins the junction of the prostatic and ampullary ducts at the albumin and mucous gland (a+m).

Habits: Two specimens were found on dead coral in the lagoon of Palmyra Atoll. The structure and arrangement of the digestive system indicates that this species is a rasping sponge-feeder. The food was not determined.

Remarks: On the basis of specimens collected in Zanzibar, ELIOT (1904) suggested that the dorid *Chromodoris aureopurpurea* COLLINGWOOD, 1881, from the China coast is a variety of *Hypselodoris tryoni*. However, *C. aureopurpurea* has characters which are sufficiently distinctive so that this species should be regarded separately from *H. tryoni* as originally suggested by COLLINGWOOD.

Specimens of *Hypselodoris tryoni* are reported from the Society Islands (GARRETT, 1873) and the Philippines (BERGH, 1877).

Hypselodoris kayae YOUNG, new species

(Text figures 8 to 11)

Description: *Hypselodoris kayae* has a smooth, elongate body with maximal dimensions of 10 mm length and 3 mm width (Figure 8). The mantle is convex and held above

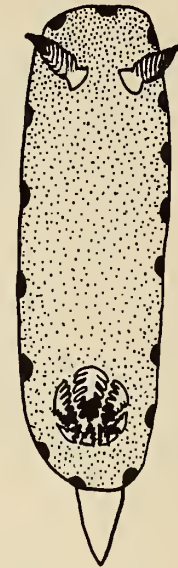


Figure 8

Hypselodoris kayae
Dorsal view of adult specimen

the foot. The elongate, white foot tapers and extends posteriorly to the mantle, which is light lilac, edged with irregularly spaced rose red spots. The rhinophores are rod-like, white with rose red tips and retractile into closely spaced sheaths; there are 8 to 9 lamellae. The 7 branchiae arc in a circlet about the posterior mid-dorsal anus; they are simply pinnate, white, tipped with rose red, smaller posteriorly and retractile into a common cavity.

The radular formula of a 10 mm specimen is 28 x 21-0-21 (Figure 9). The innermost radular tooth, 25 μ long, is bi-

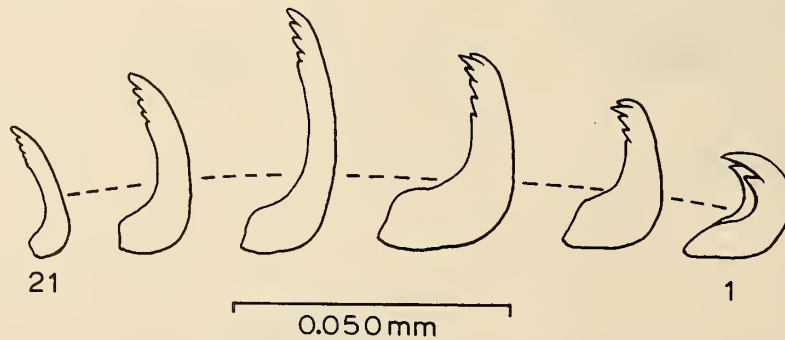


Figure 9

Hypselodoris kayae

Lateral view of the left half row of radular teeth

1 = innermost lateral

21 = outermost lateral

cuspid with a single outer denticle. The teeth increase in denticulation and size towards the center within each row to a maximal number of 4 outer denticles and a length of 46μ . The buccal armature consists of small bifid hooks, 12 to 16μ long, with broad sculptured bases (Figure 10).



Figure 10

Hypselodoris kayae
Elements of the buccal armature

The ejaculatory duct (ed), vaginal duct (v) and oviduct (od) have separate, external orifices (Figure 11).

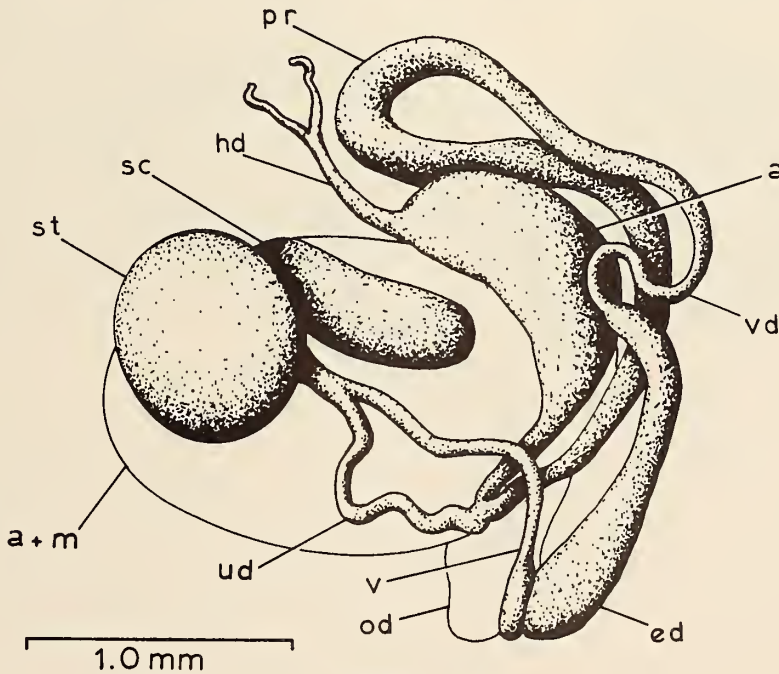


Figure 11

Hypselodoris kayae

Lateral view of the genital mass

- | | | | | |
|-----------------------|--------------------------------|------------------|---------------------|-------------------|
| a = ampulla | a+m = albumin and mucous gland | od = oviduct | pr = prostate gland | sc = spermatocyst |
| ed = ejaculatory duct | hd = hermaphroditic duct | st = spermatheca | ud = uterine duct | v = vaginal duct |
| | vd = vas deferens | | | |

No cirral hooks line the ejaculatory duct. The ejaculatory duct, vas deferens (vd) and prostate gland (pr) are loosely convolute and merge imperceptibly. The vaginal duct joins the uterine duct (ud) and forms a common vaginal-uterine duct which in turn leads to the junction of the spermatheca (st) and spermatocyst (sc). The oblong spermatocyst connects directly with the spherical spermatheca. The long, loosely convolute uterine duct passes from the vaginal duct and merges with the ampullary and prostatic ducts at the albumin and mucous gland (a+m).

Habits: Two specimens, 6 mm and 10 mm long, were collected from underneath a rock at 0.5 m depth on the northern lagoonward side of Chinimi Island, Eniwetok Atoll. They were found eating a rose-red sponge, *Aplysilla glacialis* DE LAUBENFELS, 1951, which was a common encrusting sponge upon which the dorids were inconspicuous. Spicules of this sponge were recovered from the feces of both specimens. The specimens also ate *A. glacialis* in laboratory aquaria.

An egg mass produced by the 10 mm specimen was a doubly whorled white ribbon, 15 mm long and 1.7 mm wide. The ova, 75μ in diameter, were individually enclosed

in capsules, 100 μ in diameter. There were approximately 320 ova per mm² of egg mass. The larvae hatch as free swimming veligers.

Type locality: Lagoon, north side of Chinimi Island, Eniwetok Atoll, Marshall Islands, 11° 30' N. 162° 15' E.

Type material: The holotype and the paratype (slide of radular teeth) are deposited in the Bishop Museum, Honolulu, Hawaii, where they are registered as No. 8918. The species is named for Dr. E. Alison Kay.

Diagnosis: *Hypselodoris kayae* is easily distinguished from other species of *Hypselodoris* by the light lilac mantle edged with rose red spots, the white foot, and the white rhinophores and branchiae tipped with rose red.

Remarks: Following ODHNER (1957) this new species is placed in the genus *Hypselodoris* STIMPSON, 1855 on the basis of the predominantly bicuspidate condition of the radular teeth. Further characters shared by *H. kayae*, *H. tryoni* and 5 species of *Hypselodoris* from Hawaii (KAY & YOUNG, in preparation) are the broad, sculptured bases of the buccal armature and the united condition of the uterine and vaginal ducts at the spermatheca.

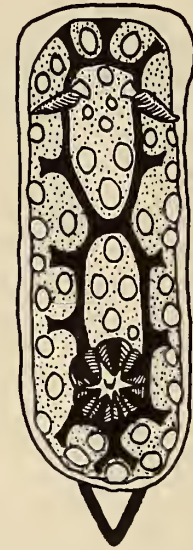


Figure 12

Chromodoris geometrica
Dorsal view of adult specimen

Chromodoris geometrica RISBEC, 1928

(Text figures 12 to 15)

Chromodoris geometrica RISBEC, 1928: 148 - 151, fig. 41, plt. VI, 10; RISBEC, 1953: 70; figs. 31, 32

Glossodoris geometrica (RISBEC), ALLAN, 1947: 441; fig. 14, plt. 41

Description: The single specimen of *Chromodoris geometrica* collected has an oblong body, 22 mm long and 8 mm wide (Figure 12). The mantle flares about the foot, expands anteriorly as a hood and narrows posteriorly as a rounded projection. The foot broadens anteriorly into two lateral projections and tapers posteriorly beyond the

margin of the mantle which is white and fluted at the edge. Rays of purple radiate peripherally from two medial, parallel, purple bands, which in turn join anteriorly to the rhinophores, posteriorly to the branchiae and centrally at mid-body length. Enclosed by the purple reticulations are white pustules upon a light yellow background. The foot is white ventrally, light yellow dorsally and bordered with a purple margin. The rhinophores are fusiform, elongate, finely lamellate and retractile into closely spaced sheaths. The peduncles are white and the lamellae are yellow. The

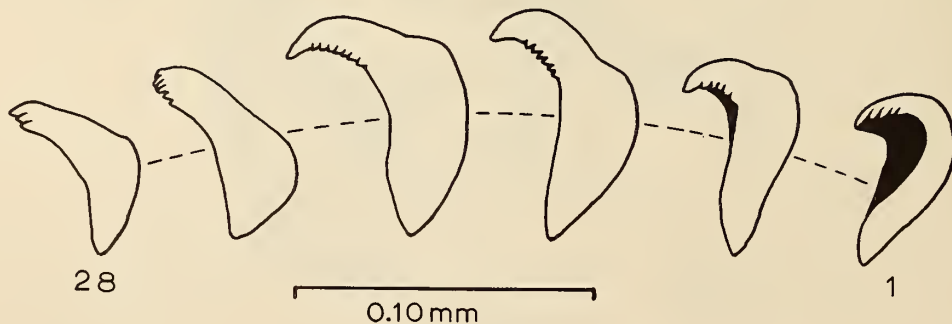


Figure 13

Chromodoris geometrica
Lateral view of the left half row of radular teeth
1 = innermost lateral 28 = outermost lateral

7 branchiae are simply pinnate with yellow rachides and transparently white pinnac; they form a circlet about the anus and decrease in size posteriorly. The rachides are quadrangular in cross section and retractile into a common cavity, but they are not vibratile as in *Hypselodoris tryoni*.

The radular formula of a 22 mm specimen is $43 \times 28.0.28$ (Figure 13). The radular teeth are unicuspid with 2 to 9 outer denticles and range from 53μ to 79μ in length. Length and denticulation of the teeth increase centrally within each row. The outermost teeth are denticulate only at their tips. The buccal armature consists of simple bifid hooks, 32μ to 39μ long, with smooth bases (Figure 14).

The ejaculatory duct (ed), vaginal duct (v) and oviduct (od) have separate external openings (Figure 15). There are no cirral hooks in the ejaculatory duct. The prostate gland (pr) is long and tightly convoluted. The vaginal duct merges in a common duct with the uterine and spermatocystic duct which in turn passes into the



0.025 mm

Figure 14

Chromodoris geometrica
Elements of the buccal armature

spherical spermatheca (st). The spermatocyst (sc) is pyriform and approximately half the size of the spermatheca.

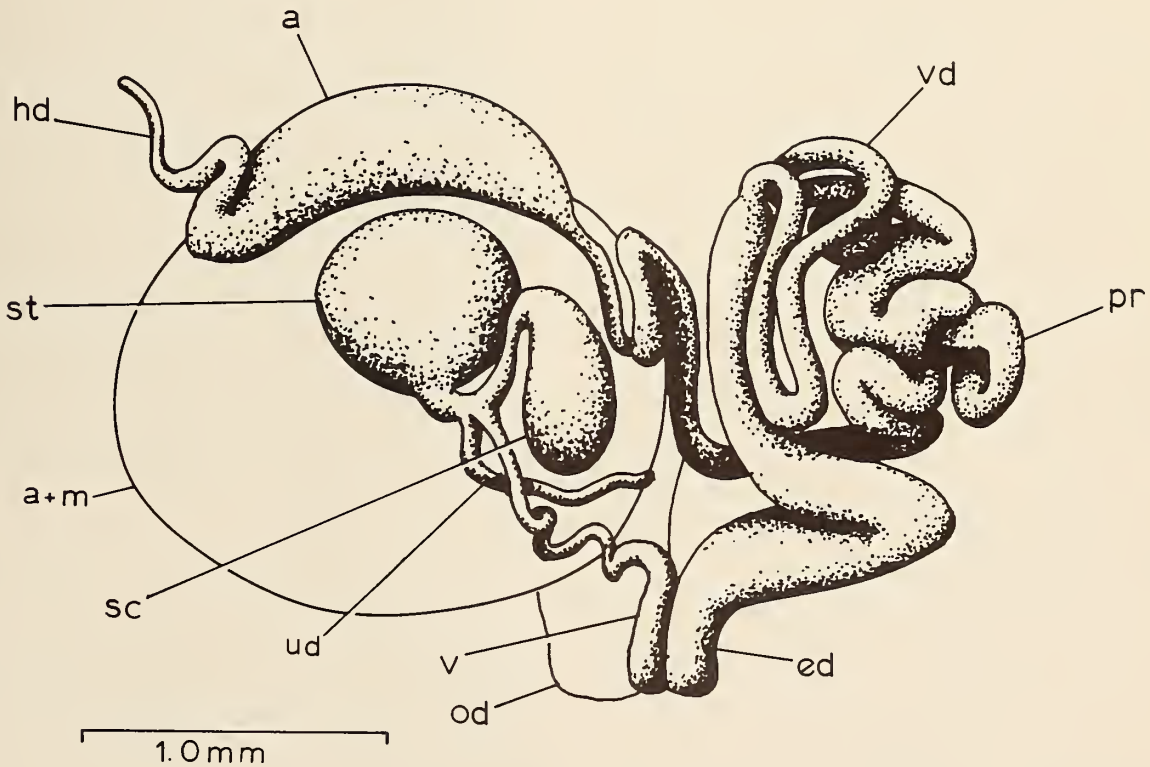


Figure 15

Chromodoris geometrica

Lateral view of the genital mass

- | | | | | |
|-----------------------|--------------------------------|------------------|---------------------|-------------------|
| a = ampulla | a+m = albumin and mucous gland | od = oviduct | pr = prostate gland | sc = spermatocyst |
| ed = ejaculatory duct | hd = hermaphroditic duct | st = spermatheca | ud = uterine duct | v = vaginal duct |
| | vd = vās deferens | | | |

The uterine duct (ud) enters the albumin and mucous gland (a+m) separately from the ampullary and prostatic ducts.

Habits: One specimen was found under an intertidal rock on the northern lagoonward side of Chinimi Island, Eniwetok Atoll. The food was not determined but the structure and form of the digestive tract suggest that this species is a rasping sponge-feeder.

Remarks: The occurrence of this specimen at Eniwetok Atoll is the northernmost record for *Chromodoris geometrica*, which was previously reported only from New Caledonia (RISBEC, 1928, 1953) and New South Wales (ALLAN, 1947).

Chromodoris lilacina (GOULD, 1852)

Doris lilacina GOULD, 1852: 297

Doris amabilis KELAART, 1859: 294 - 295

Chromodoris porcata BERGH, 1888: 831 - 833

Chromodoris amabilis (KELAART), ELIOT, 1906: 642, pl. XLII, fig. 1

Glossodoris amabilis (KELAART), PRUVOT-FOL, 1951: 84

Description: External morphology and coloration of one specimen are described by GOULD (1852). The reproductive system and the radular teeth in addition to further descriptions of external morphology are presented and figured by KAY & YOUNG (in preparation).

Habits: Two specimens (8 and 14 mm long) were collected on separate occasions from 0.5 m of water at the lagoon side of the northern end of Chinimi Island, Eniwetok Atoll. The food was not determined. Specimens of *Chromodoris lilacina* in Hawaii feed on *Mycalae maunakea* DE LAUBENFELS, 1951, a sponge not reported from Eniwetok (unpublished data).

Remarks: The species described by KELAART (1859) as *Doris amabilis* and suggested by PRUVOT-FOL (1951) to be a glossodorid, probably is synonymous with *Chromodoris lilacina*. ELIOT (1906) figured the original of KELAART and suggested that it may be a chromodorid. ELIOT further suggested the synonymy of *C. porcata* (BERGH, 1888) with *C. amabilis*.

Specimens of *Chromodoris lilacina* are reported from Ceylon (KELAART, 1859), Mauritius (BERGH, 1888) and Hawaii (GOULD, 1852).

Chromodoris albopustulosa (PEASE, 1860)

Doris albopustulosa PEASE, 1860: 30

Chromodoris albopustulosa (PEASE), BERGH, 1884: 70

Glossodoris albopustulosa (PEASE), PRUVOT-FOL, 1947: 108; PRUVOT-FOL, 1951: 83

Description: The external characters of *Chromodoris albopustulosa* are described by PEASE (1860). External morphology, reproductive system, and radular teeth are

further described and figured by KAY & YOUNG (in preparation).

Habits: One 10 mm specimen was collected under a rock in 2 m of water in the quarry on Eniwetok Island. The structure and form of the alimentary tract suggest that this species is a rasping sponge-feeder, although the food was not determined.

Remarks: The occurrence of this specimen at Eniwetok Atoll is the only definite record of *Chromodoris albopustulosa* outside of the Hawaiian Islands (PEASE, 1860) as BERGH (1884) merely records it from the Pacific.

Jorunna tomentosa (CUVIER, 1804)

Description: A synonymy is given and external and internal characters are discussed by PRUVOT-FOL (1954). A specimen is figured by PRUVOT-FOL (1953). The reproductive system with its characteristic stylet is figured by BERGH (1880) and PRUVOT-FOL (1954). Additional descriptions of external and internal morphological characters are given and the radular teeth and the reproductive system are figured by KAY & YOUNG (in preparation) from specimens collected from the Hawaiian Islands.

Habits: One 18 mm specimen of *Jorunna tomentosa* was collected under a rock in 0.5 m of water on the northern lagoonward side of Chinimi Island. This species is reported to be a sponge-feeder in Europe (MILLER, 1961; THOMPSON, 1964) and Hawaii.

Remarks: *Jorunna tomentosa* is reported by PRUVOT-FOL (1954) to be distributed from 65° N latitude in Scandinavia down the coasts of Great Britain and France and into the Mediterranean Sea. This species is the only dorid collected which is not restricted in distribution to the Indo-West-Pacific faunal region. The occurrence of specimens of *J. tomentosa* in European waters as well as in Pacific waters suggests a cosmopolitan distribution.

DENDRODORIDIDAE

Dendrodoris nigra (STIMPSON, 1855)

Description: A synonymy is given and external morphological characters of adult specimens are described by MARCUS & BURCH (1965). External and internal morphological characters of this common Indo-West-Pacific dorid throughout different stages of its growth are described and figured by KAY & YOUNG (in preparation).

Habits: Twelve specimens of *Dendrodoris nigra* (4 to 30 mm long) were collected during the 3 week period: 9 from the quarry on Eniwetok Island and 3 from the northern lagoonward side of Chinimi Island. All specimens were black with white spots except for the smallest which

was orange and similar in coloration to juvenile specimens of *D. nigra* in Hawaii. One specimen (12 mm preserved length) was also collected on a head of *Porolithon* sp. inside the fringing reef at Johnston Island in August, 1965.

Remarks: Although there were no direct observations of feeding, fluorescence-microscopical examinations of material from the gut and feces indicated a complete absence of organic matter of plant origin with the exception of several errant diatoms. Lacking radular teeth, these specimens are probably sucking sponge-feeders as are those in Hawaii.

Dendrodoris nigra is not only one of the most abundant dorid species in Hawaii and at Eniwetok, but also one of the most widely distributed and frequently recorded dorids in the Indo-West-Pacific. This is the only species of dorid collected which has been previously recorded from Eniwetok. MARGUS & BURCH (1965) report 13 specimens of *D. nigra* collected on Parry and Japtan Islands, Eniwetok Atoll, during Spring 1960.

POLYGERIDAE

Gymnodoris citrina (BERGH, 1877)

(Text figures 16 to 18)

Trevelyana citrina BERGH, 1877: 440-443; pl. 56, figs. 18-25

Description: *Gymnodoris citrina* has a limaciform body measuring 6 to 24 mm long (Figure 16). The dorsum, which is cream or light yellow with small orange tipped pustules, is sparsely scattered with irregularly shaped epidermal spicules which are 120μ to 250μ in length and pointed at one or both ends. Anteriorly there is a broad cephalic hood edged with orange tipped serrations. In dorsal view the lobiform oral tentacles project anterolaterally beyond the edge of the cephalic hood, the genital orifice protrudes from the right side of the body immediately anterior to the level of the branchiae and the body tapers posteriorly with the elongate foot. The rhinophores, positioned laterally in the cephalic hood, are club-like in shape, bear 15 to 20 light yellow lamellae and may be tipped with orange. The 8 to 9 branchiae, in a horseshoe-shaped placement about the mid-dorsal anus, are simply pinnate, flattened laterally and smaller posteriorly; they are light yellow and often tipped with orange. Characteristically, but macroscopically visible only in large specimens, is a slightly raised V-shaped area edged with shallow, orange tipped serrations projecting and tapering posteriorly from the level of the branchiae to the posterior one-third of the body.

The radular formula of 3 specimens (6, 10, and 24 mm) is 10-18 x 14-30·0·14-30 (Figure 17). The first lateral tooth is simply hamate and larger than the succes-



Figure 16

Gymnodoris citrina
Dorsal view of adult specimen

sive teeth in each row, varying from 142μ to 390μ long in 6 mm and 24 mm specimens respectively. The second lateral tooth is awl-shaped and broadly based, whereas the following teeth are successively narrower and shorter. At the buccal lip are paired unarmored cuticular thickenings.

Three ovate, orange-red ovotestes lie anteroventral to the digestive gland. Components of the genital mass were not discernible in the specimens dissected, excepting the long and tightly convoluted male duct system. Numerous cirral hooks, 7μ to 8.5μ long, line the lumen of the ejaculatory duct (Figure 18).

Habits: Six specimens were collected at Eniwetok Atoll. One was found in the quarry on Eniwetok Island and 5 on the northern lagoonward side of Chinimi Island under rocks in 0.5 m of water. An egg mass containing late stage veliger larvae, 150μ to 162μ in diameter, with an opisthobranch larval shell type 1 (terminology according to THOMPSON, 1961) was the only identifiable food found in the midgut of one specimen of *Gymnodoris citrina* collected in the field. One conclusion resulting from the category of this larval shell type is that the veligers are not of acolid origin, as acolids have a different type of larval

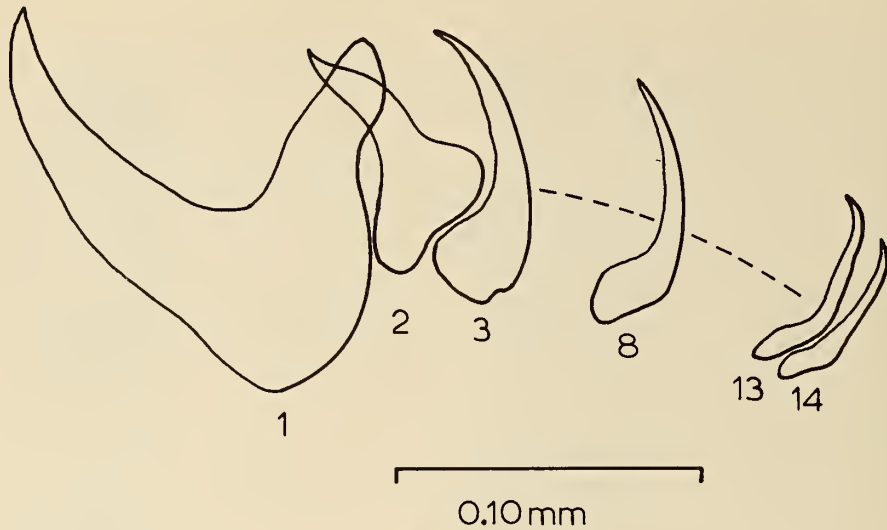


Figure 17

Gymnodoris citrina

Lateral view of right half row of radular teeth

1 = innermost lateral 2 = second lateral . . .
14 = outermost lateral

shell from that of other opisthobranchs. A 10 mm specimen devoured a 6 mm specimen in the laboratory but this occurrence was probably induced by unnaturally crowded conditions in the aquarium.

Remarks: Since the name *Trevelyana* (= *Gymnodoris citrina*) was first proposed by BERGH (1877) for an 11 mm specimen from the Palau Islands, it has been put into the synonymy of *Gymnodoris bicolor* (ALDER & HANCOCK, 1866) by a number of workers (e. g. RISBEC, 1953; MACNAE, 1958; BABA, 1960). Comparison of internal and external characters of *G. bicolor* and *G. citrina* indicates that the two species are distinct.

Much of the difficulty and confusion which have arisen concerning *Gymnodoris bicolor* and *G. citrina* are apparently because the first lateral tooth is larger in relation to the succeeding outer lateral teeth in both species. A comparison also reveals that the innermost laterals of *G. citrina* are much larger than those of *G. bicolor* in similar sized specimens. In fact, the 120 μ length of the innermost lateral tooth in a 22 mm specimen of *G. bicolor* from Hawaii (KAY & YOUNG, in preparation) is even shorter than the 142 μ length of the similar tooth in a 6 mm specimen of *G. citrina* from Eniwetok.

The broad base and awl-shaped cusp of the second lateral tooth is a useful specific character for *Gymnodoris citrina* as stated by BERGH (1877). The 180 μ length of the innermost lateral tooth from the 11 mm specimen of BERGH also agrees favorably with the 165 μ length of the similar tooth from a 10 mm specimen in this study.

RISBEC (1928) described two species of *Trevelyana* (= *Gymnodoris*), *T. perlucens* and *T. suggens*, from New Caledonia. Both were later put into the synonymy of *T. bicolor* (RISBEC, 1953). In the latter work, RISBEC describes "un nouvel exemplaire," literally "a new specimen," which he states is intermediary in certain characters to the *T. perlucens* and *T. suggens* "forms" of *T. bicolor*. This new specimen described by RISBEC (1953) exhibits many diagnostic characters of *G. citrina*. Among the common ones are: "... papilles oranges disposées en V en arrière des branchies et les encadrant ... plaques



Figure 18

Gymnodoris citrina
Cirral hooks

cornées incolores situées en avant de la rotella ... La 1^{re} latérale a une cuspidé de 0.24 mm de long ... La glande génitale est formée de trois masses arrondies d'un rouge foncé ... le canal déférent est plus long." (RISBEC, 1953, pp. 100 - 101). The specimen figured by RISBEC (1953, fig. 57) bears a greater resemblance to *G. citrina* than to *G. bicolor*.

Although only one specimen of *Gymnodoris citrina* has been reported from the Palau Islands (BERGH, 1877), the species is likely to be further distributed throughout the Indo-West-Pacific faunal region. Because past species descriptions have not always been sufficient to enable one to distinguish between *G. citrina* and *G. bicolor*, the distributions of both species remain uncertain.

VAYSSIÉREIDAE

Okadaia elegans BABA, 1930

Description: Synonymies are given and certain aspects of the biology of *Okadaia elegans*, including descriptions of the external and internal morphology, are discussed by BABA (1937).

Habits: Numerous specimens of *Okadaia elegans* were found in the shallow tide pool at the northern lagoonward side of Eniwetok Island. These minute limaciform dorids with a maximal length of 4 mm were found feeding on spirorbid polychaetes on the undersides of rocks in the area. In penetrating the calcareous exoskeleton of a spirorbid polychaete, *O. elegans* bores a hole through the tube with its radular teeth.

The egg masses of *Okadaia elegans* were deposited as flattened gelatinous masses on the undersides of rocks at the collecting site and on the sides of aquaria in the laboratory. Juvenile forms, 0.55 mm to 0.70 mm long, emerge from individual capsules contained in each egg mass within 10 days after oviposition at 26° to 27° C and feed upon spirorbid polychaetes in a similar manner as the adult forms.

Remarks: Previously reported from Japan (BABA, 1930, 1931, 1937) and commonly found in Hawaii, this species is likely to be found throughout the Indo-West-Pacific faunal area if a careful examination is made of substrata colonized by spirorbid polychaetes. Specimens of *Okadaia elegans* are likely to be overlooked because of their small sizes. Species closely allied to *O. elegans* have been reported from New Caledonia (RISBEC, 1928), New Zealand (RALPH, 1944), and Formosa (COLLINGWOOD, 1881).

AEOLIDACEA

FAVORINIDAE

Herviella mietta MARCUS & BURCH, 1965

Description: MARCUS & BURCH (1965) discuss external and internal morphological characters, and figure an adult specimen, a radular tooth, a jaw and a penial stylet in their original description of *Herviella mietta* from 16 specimens from Eniwetok.

Habits and Remarks: Twelve specimens of *Herviella mietta* (5 mm to 10 mm long) were collected intertidally on the northern lagoonward side of Eniwetok Island, the same location where 13 specimens were collected in 1960 (MARCUS & BURCH, 1965). A single 8 mm specimen was also collected intertidally under a rock on the western lagoon side of Igurin Island, the only nudibranch collected at this island.

Numerous egg masses of *Herviella mietta* were deposited in the collecting area on the undersides of rocks and even on the shells of specimens of the prosobranch, *Cerithium sejunctum* IREDALE, 1929. The larvae pass the veliger stage within the egg mass and each emerges in the crawling stage with the larval shell yet attached within 6 days after oviposition at 28° to 29° C. Within 24 hours after hatching the larval shells are dropped. The juvenile forms bear 2 simple cerata.

Unreported in the description of the species is the feeding of *Herviella mietta* on the eggs of the prosobranch gastropod *Cerithium sejunctum*. This association is likely to be a seasonal occurrence during the spawning of *C. sejunctum* and the aeolid is probably a hydroid-feeder during the remainder of the year. Additional evidence that another food is eaten by these aeolids is that newly hatched juveniles of *H. mietta* do not feed on the eggs of *C. sejunctum*. Variation from a hydroid diet by aeolids is reported in England for *Calma glaucoides* (ALDER & HANCOCK, 1855) which feeds on demersal fish eggs (EVANS, 1922; ROWETT, 1946) and in Hawaii where an unidentified species of aeolid feeds on the eggs of the opisthobranch gastropod *Aplysia juliana* QUOY & GAIMARD, 1832 (E. Alison Kay, personal communication).

Specimens of *Herviella mietta* were the only nudibranchs eaten by a butterfly fish (*Chaetodon auriga*) which was kept in a large sea water tank in the Eniwetok Marine Biological Laboratory. All other nudibranchs collected were rejected after they were initially taken into the mouth of the fish. The nudibranchs were not visibly harmed by such treatment and thereafter were not taken in by the fish after an initial investigation. Specimens of *H. mietta* were readily eaten by the fish on every occasion,

even when the fish was fed to apparent satiation with other food. This is one of the few occasions that possible predation on aeolid nudibranchs by fish has been demonstrated (see EDMUNDS, 1966).

Herviella claror BURN, 1963

Description: MARCUS & BURCH (1965) expanded on the description of *Herviella claror* BURN, 1963 and figured an adult specimen, a radular tooth and a jaw on the basis of 3 specimens collected from Eniwetok.

Habits and Remarks: Two specimens (13 mm and 15 mm long) of *Herviella claror* were found in the quarry on Eniwetok Island not far from the north end of the same island where 3 specimens were collected in 1960 (MARCUS & BURCH 1965). This species was described from a specimen collected in New South Wales (BURN, 1963).

SUMMARY

Nine new geographic records, 3 confirmatory geographic records and one new species, *Hypselodoris kayae*, representing 2 superfamilies and 5 families of the Nudibranchia are reported from 3 atolls (Eniwetok, Palmyra and Johnston Island) in the Central and West-Central Pacific. With one exception of a presumed cosmopolitan species, *Jorunna tomentosa*, all the nudibranchs are limited in distribution to the Indo-West-Pacific faunal region. Six species co-occur in Hawaii and Eniwetok.

Only 1 of the 7 species of Doridacea previously reported from Eniwetok was found. This difference probably reflects the seasonality in occurrence of dorids in shallow water. The 2 species of Aeolidacea previously reported from Eniwetok are verified.

The foods of 3 sponge-feeders, *Doriopsis viridis*, *D. pecten*, and *Hypselodoris kayae*, and one polychaete feeder, *Okadaia elegans*, are reported. Two occurrences of predation by nudibranchs on egg masses of gastropods are given. It is verified that specimens of *Herviella mietta* feed on egg masses of a prosobranch gastropod and suggested that specimens of *Gymnodoris citrina* feed on egg masses of an unknown opisthobranch gastropod.

Three general types of larval development are shown by the nudibranchs collected. The larvae of *Doriopsis viridis* and *Hypselodoris kayae* emerge from egg masses as free swimming veligers. The larvae of *Herviella mietta* hatch as crawling larvae that drop their shells within 24 hours. The larval stages of *Okadaia elegans* are completed within egg masses from which emerge juveniles that are capable of adult feeding habits.

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